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Space Administration
NASA
Spaced Out Sports
80
pacedoutsports

Spaced Out Sports

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http://www.nasa.gov/externalflash/education/CCLC/001-SOS-Challenge-Overview.v2.cc.m4v

Spaced Out Sports

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- Challenge
  - Design a sport using Newton's Laws of Motion that will be played by the astronauts in the microgravity environment of the International Space Station
  - Requirements:
    - 3-6 team members
    - 3-5 minute video
    - Uses only materials available on ISS
    - Create a Game Instructions document with the objective, materials and rules of your game

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http://www.nasa.gov/externalflash/education/CCLC/Nastia-Liuken-CAP.mp4

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http://www.nasa.gov/externalflash/education/CCLC/Gernhardt-CAP.mp4

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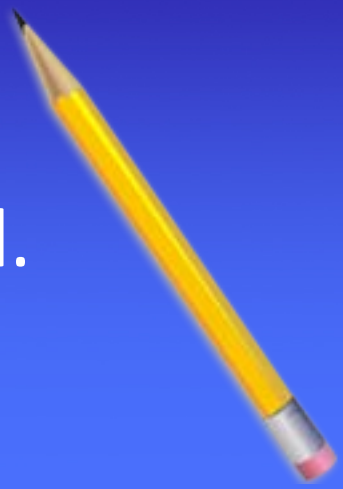
Center of Mass

The center of mass is the balance point of an object, or the point at which all the mass is concentrated.

Find the center of mass for your pencil.



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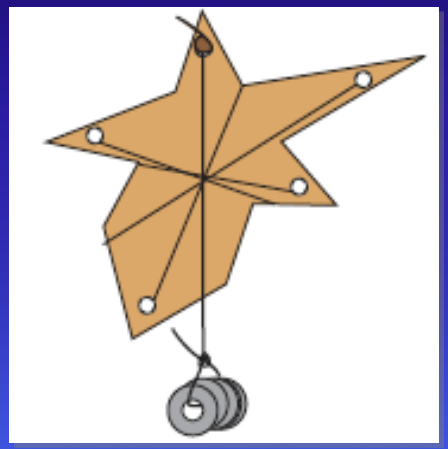
Center of All Things Activity

Procedure:



1. Gather the following materials:
    - Cardboard star
    - String with washers attached
    - Small stick
    - Pencil
2. Insert the stick through one of the holes in the star points.
3. Let the star hang freely.

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Procedure:

4. Hang the loop of the string on the stick so that the washers hang below.
5. While keeping the star and string still, draw a straight pencil line across the star right next to the string.
6. Repeat steps 2-5 for the other star points.

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Center of All Things Discussion Questions

- What happened to all the lines you drew?
- Where do you think the center of mass for your star is located? Explain why you think it is in this location.
- Do you have a center of mass? Where is it?

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Center of All Things Discussion Questions

Why is the center of mass important for astronauts?

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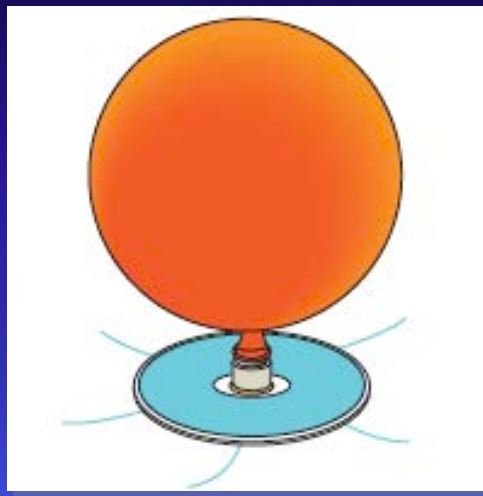
Hovercraft Activity



Procedure:

1. Blow up your balloon.
2. Twist the balloon so that the nozzle is closed off and press the small end of the stopper into the upper end of the PVC pipe in the hover craft. The hovercraft is ready to launch.
3. Place the craft on a smooth, level surface such as a table top.

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Procedure:

4. Release the balloon. It will untwist and start blowing air downward through the small hole in the center.
5. Experiment with the optimum size of the hole in the paper dot. The hole can be enlarged by pushing the point of a pencil into it.

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Hovercraft Challenge

Challenge - Distance

How far can you make your hovercraft travel before it stops on its own? Try three times.

First Run Distance in cm	Second Run Distance in cm	Third Run Distance in cm	Average Distance in cm

What did you do to try to increase your distance? Did it work?

Challenge - Time

How long can you make your hovercraft hover before it comes to a rest on its own? Try three times.

First Run in seconds	Second Run in seconds	Third Run in seconds	Average Time in seconds

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Hovercraft Challenge

Challenge - Speed

How fast can you make your hovercraft move? Measure distance and time. Try three times.

First Run	Second Run	Third Run
cm / sec	cm / sec	cm / sec

$$\text{Speed} = \frac{\text{distance}}{\text{time}} = \_\_\_\_ \text{ cm/sec}$$

First Run speed in cm/sec	Second Run speed in cm/sec	Third Run speed in cm/sec	Average Speed in cm/sec

What did you do to try to increase your speed? Did it work?

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Hovercraft Discussion Questions

- What causes the hovercraft to become frictionless?
- What happens to the hovercraft's movement when the balloon runs out of air? Why?
- How do different surfaces affect the hovercraft?
- How does the size of the paper dot hole affect the hovercraft?

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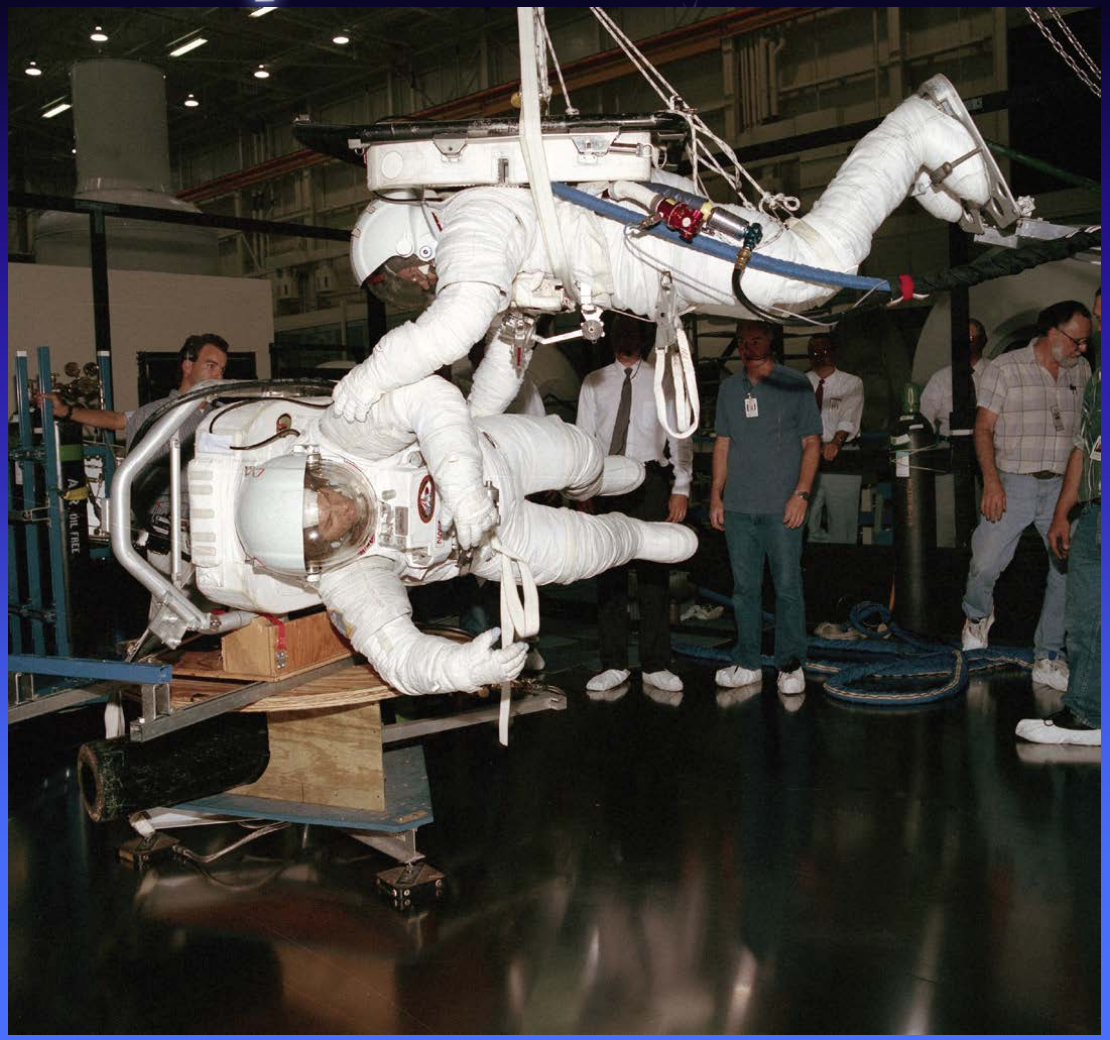
- How can hovercraft technology be used to simulate microgravity when training astronauts?

- How can astronauts practice for the microgravity environment on the ISS?

force = mass x acceleration
(F=*m* x *a*)



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Javelin Rockets Activity

Procedure:

Gather your materials:

- PVC pipe
- Javelin Rocket pattern
- Scissors
- Tape
- Velcro

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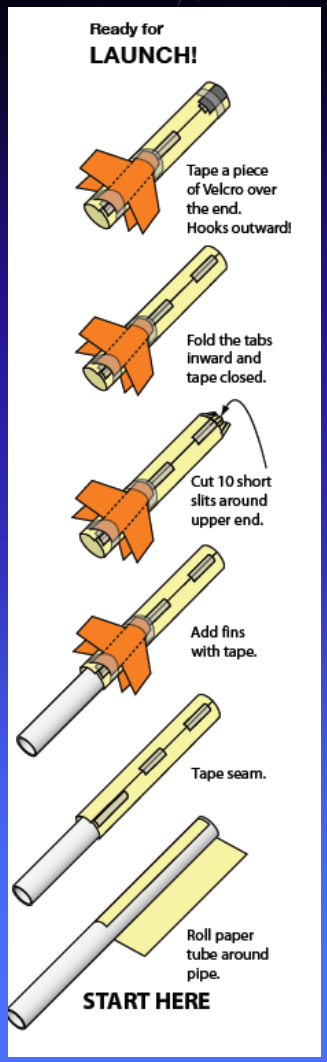
Javelin Rockets Activity

How to make your javelin rocket:

1. Roll paper tube around pipe.
2. Tape seam all the way.
3. Add fins with tape
4. Cut a few short slits around upper end.
5. Fold the tabs inward and tape closed.
6. Tape a piece of velcro over the end. Hooks outward!



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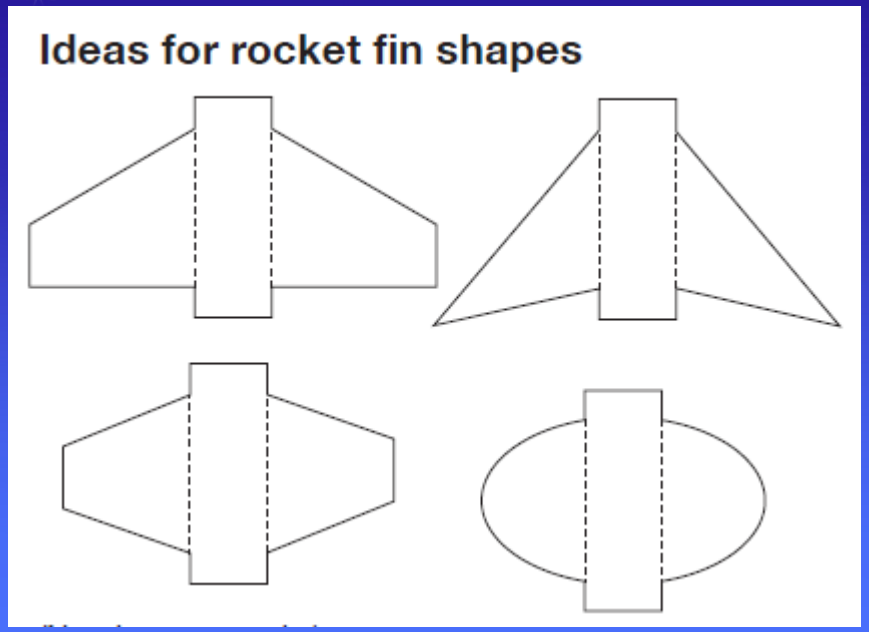
Javelin Rockets Activity

Ideas for rocket fin shapes:



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Javelin Rockets

- Launch your rocket several times, using the same amount of force.
- Describe how your rocket flew – straight, curved, spun?
- Did you do anything to make it fly better?

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Javelin Rockets Discussion Questions

- Will rockets travel farther across the surface of the moon or Mars if the same launch force is used?
- If rocket javelins were flown inside the International Space Station, how would they need to be aimed to hit the target?

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Newton's First Law of Motion

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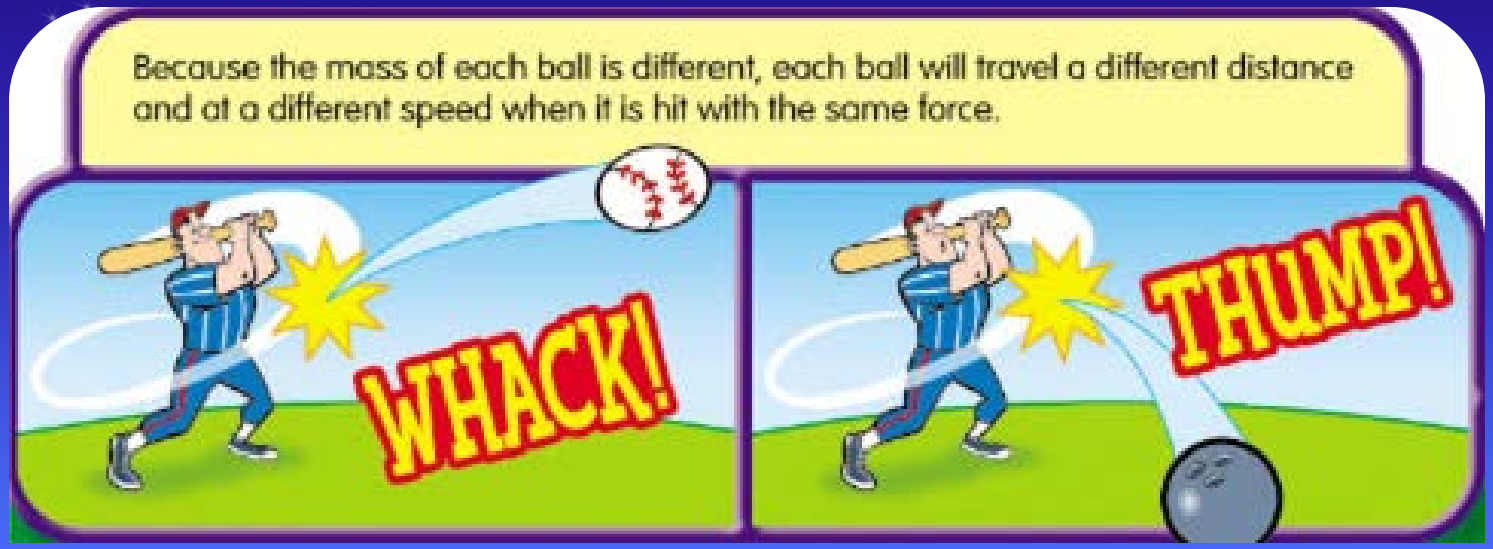
Newton's Second Law of Motion



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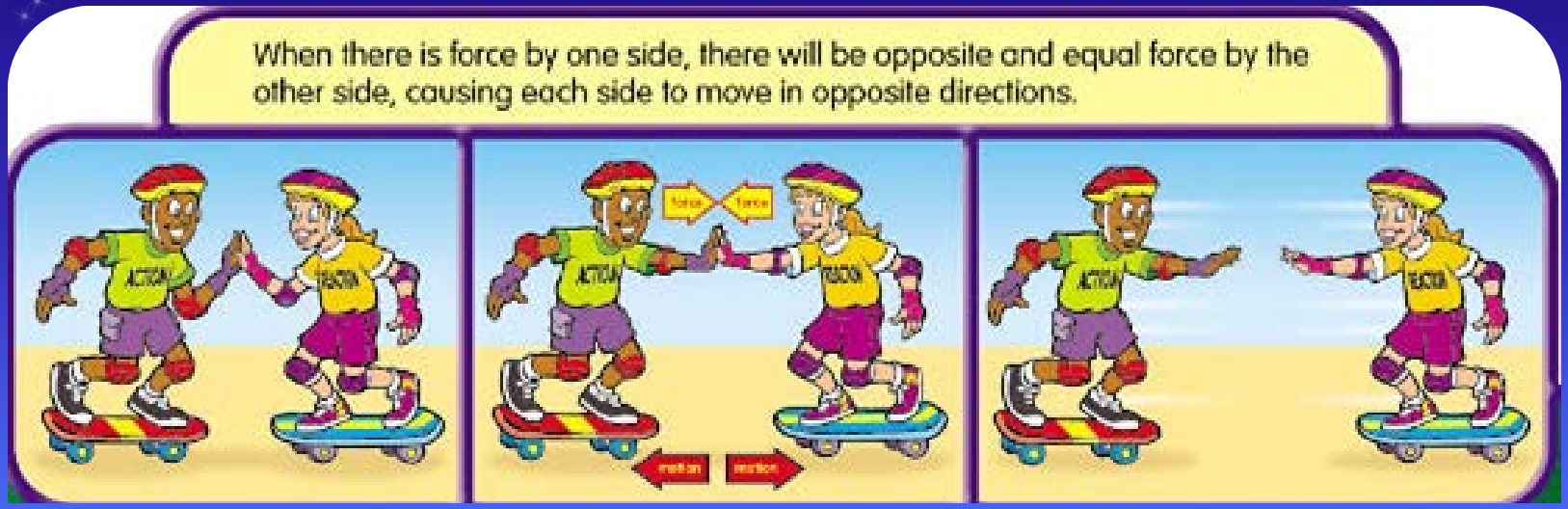
Newton's Third Law of Motion



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Materials Available on the ISS
(choose 5 or less to use with your game)

- Cotton handkerchief
- T-shirts
- Washcloth
- Towel
- Athletic exercise band
- Bungee cords
- Cotton swabs
- String
- Alligator clips
- Velcro
- Duct tape
- Pens
- Pencils
- Paper
- Markers
- Flashlights

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